DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
Washington, DC 20314-1000

EM 1110-2-6051

CECW-EW

Manual
No. 1110-2-6051

22 December 2003

# Engineering and Design
# TIME-HISTORY DYNAMIC ANALYSIS OF CONCRETE HYDRAULIC STRUCTURES

**1. Purpose.** This manual describes procedures for the linear-elastic time-history dynamic analysis and development of acceleration time-history dynamic analysis for seismic design and evaluation of concrete hydraulic structures (CHS). The manual also provides guidance on the formulation and performance of the linear-elastic time-history dynamic analyses and how the earthquake input time-history are developed and applied.

**2. Applicability.** This manual applies to all USACE commands having responsibility for civil works projects.

**3. Distribution.** Approved for public release; distribution is unlimited.

**4. Discussion.** Chapter 1 provides an overview of the seismic assessment process for CHS and the responsibilities of the project team involved in the process. In Chapter 2, methodology for analytical modeling of concrete hydraulic structures is discussed, including types of CHS, analytical modeling procedures, fluid-structure interaction, and foundation-structure interaction. Chapter 3 describes time-history numerical solution techniques. Chapter 4 describes methodology for structural performance and damage criteria. Chapter 5 describes methodology for developing of acceleration time-histories. Examples of earthquake response evaluation are provided in Chapter 6.

FOR THE COMMANDER:

6 Appendices
(See Table of Contents)

MICHAEL J. WALSH
Colonel, Corps of Engineers
Chief of Staff